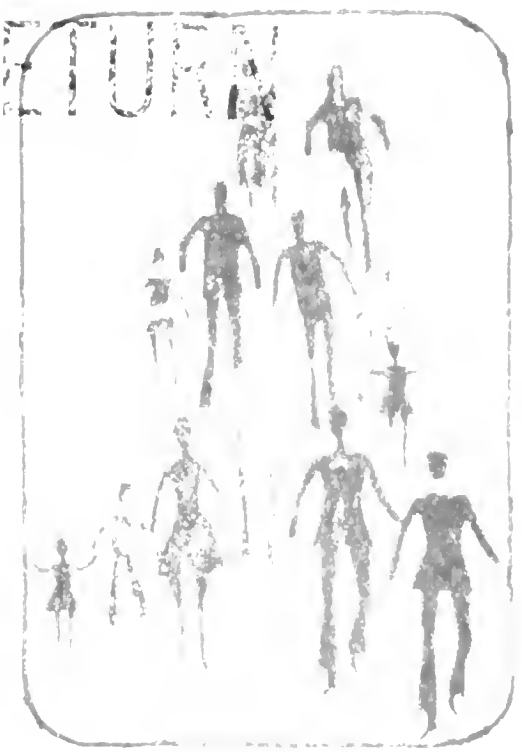
DCA

ENT POPULATION
ATION PROCEDURES
ATE GOVERNMENTS



An Inventory of Current Local Area Population Estimation Procedures In Use By State Governments

Prepared By

Richard E. Dodge, Statistician

C. R. Draper, Administrator

Division of Research and Information Systems

Montana Department of Community Affairs

April 1975

Helena, Montana

59601

Table of Contents

I Introduction

The purpose of this survey was to begin to develop a worthwhile program for estimating city and town populations in Montana. Since no precedent existed for establishing such a program it was decided to find out what other state governments were making city and town estimates, and how. A letter was sent to each state governor's office requesting information on any city estimation procedures currently being used within their state government. The response to these inquiries was a gratifying 86 percent. While many states did not have an existing program, some had advanced and detailed programs. The final results of the survey are published in Part III of this report. Since it would be difficult to talk about procedures used to estimate local area population without some type of background in demography, an attempt is made in Part II of this report to give the reader a sort of primer on estimating techniques. Most of the material in Part II has been abstracted from three principal sources. These are: The Methods and Materials of Demography, Vol. II, 1971, U. S. Bureau of Census; Procedures for Processing Population Estimates and Projections for State Tax Sharing in Wisconsin, Wisconsin State Bureau of Planning and Budget, 1973; and Population Trends 1974, Office of Program Planning and Fiscal Management, State of Washington.

The final part of this report is a bibliography of sources on methods and procedures used in small areas estimation. This listing is a composite of bibliographies obtained from the survey.

II Estimating Techniques

The most complete and reliable source of population information is the decennial census, based on a house-to-house enumeration. However, since population distribution is constantly changing it is not always adequate to use five- or ten-year-old statistics based on a previous census. The Bureau of Census itself is in the process of developing local area population estimates for revenue sharing since 1970 census counts do not reflect current population adequately. It is important to note then that population estimates are not complete counts but only substitutes for them. It is only by accident that an estimate will ever be exactly equal to a true count; however, one would always like to choose the methods that yield estimates close to the true counts.

The major advantage of estimates over actual counts is lower costs. It would be far more expensive to do a complete census of a county or city than to collect good symptomatic data for estimating the population. While some data might be rather expensive to collect (the Census Bureau estimated that it cost $.10 a record for 76 million records to estimate local population from IRS data), other sets of data exist just for the asking. Birth and death records for cities and towns are almost always available through the State Department of Health or the National Center for Health Statistics. School enrollment data can usually be obtained at the State Educational Department. Likewise, automobile registration data is sometimes available through the State Highway Department.

Enrollment and automobile registration data are good examples of symptomatic data on population change, and if they are automated (available on computer tapes or cards) they are particularly appealing. However, to be useful it is almost always necessary that the above data be available for a "base year" -- usually the census year of 1970. It is even more rewarding if the data is available for earlier censal periods as this allows one to check the estimates for accuracy. Types of data and their application to local area estimation are covered in the last part of the methodology section.

Estimates can be divided into several types on the basis of time reference and the basis of their derivation. Demographers generally classify estimates into one of three categories. These are:

(1) Intercensal Estimates -- an estimate of a population between two censuses.

(2) Postcensal Estimates -- an estimate of a population following the latest census.

(3) Projections -- an attempt to predict the population of an area at some future time.

The term "population estimate" generally refers to the estimates defined in (2), while the term "population projection" always refers to the

third type of estimate. Projections are made by constructing mathematical models to reflect the operation of the vital events -- birth and death -- and to reflect the less predictable phenomenon of migration. Naturally, the number produced by a projection method is quite sensitive to the assumptions regarding births, deaths and migration which are built into the model.

Postcensal estimates can generally be accomplished by using procedures and models tied to actual current data. The growth or decline of an area's population affects such things as school enrollment, automobile registration, and the number of births and deaths in an area. In other words, to make population estimates one should use symptomatic data on variables that are strongly correlated with population size. The key then, to estimating local area population, is to develop some way of determining or estimating the relationships between the symptomatic data and the population size.

The next section contains descriptions of methodologies currently being used by state governments to estimate local area population. While county populations are being estimated by the Bureau of Census, no federal-cooperative program exists at this time for city and town estimates. The purpose of the next section is to give some elementary insight into current methodology being used to estimate city and town populations.

Methodology

Methods for estimating local area populations are usually classified as one of four types. These are:

(1) Component Methods

(2) Composite Methods

(3) Censal-Ratio Methods

(4) Ratio-Correlation Methods

At the city and town level the use of one methodology or another is most often dictated by data availability. Should one be fortunate enough to be able to choose between types of methods to use, a test and evaluation system should be set up to check estimates against actual counts.

(1) Component Methods

Component methods use current symptomatic data to measure net migration which is combined with birth and death statistics to estimate population change. The general equation can be presented as:

$$P_2 = P_1 + B - D + NM$$

P_2 = current population

P_1 = base population (1970 census)

B = number of births between P_1 and P_2

D = number of deaths between P_1 and P_2

NM = net migration between P_1 and P_2

where P_1 can usually be obtained from the Bureau of Census while the number of births and deaths can be obtained from the State Department of Health or the National Center for Health Statistics. Current data on net migration is hardly ever available and thus net migration for the area must usually be estimated using symptomatic data. The equation then becomes:

$$\hat{P}_2 = P_1 + B - D + \hat{NM}$$

where $\hat{P}_2$ and $\hat{NM}$ are estimates of current population and net migration. The most common known variant of the component methods is the Component Method II developed by the Bureau of Census. In this method school enrollment is used to measure net migration. Other types of data which have proved useful or may prove useful in estimating net migration for small areas include data from the family allowance system, the social security system, tax records, automobile registration, voter registration or any other data resulting from registration which would symptomize changes in population.

(2) Composite Methods

The composite method uses data from a number of sources to estimate various age groups of the local population. An estimate is then derived for the entire population of the area by summing the independent age group estimates. For example, the number of deaths of persons 45 years old and over by age may be used to estimate the population in this age

range; the number of births may be used to estimate the number of females in the child bearing ages (18 to 44 years), which, in turn, may be used to estimate the number of males in this age range; school enrollment data may be used to estimate the population of school ages (5 through 17 years old); and the number of births in the previous 5-year period, in conjunction with school enrollment data, may be used to estimate the population under 5 years of age. Tax records and voter registration records may also be used as a source of data. The most widely used variation of the composite method is the Bogue-Duncan Method. Essentially, this method is used to compute local area estimates in the following manner:

a. Estimate the 45 and over population by dividing age-sex-color specific death rates into corresponding death registration for the estimate year.

b. Estimate females 15 through 44 years old using birth statistics. Tabulated by age and color of mother.

c. Compute the male population 15 through 44 years old using age-color specific sex ratios in conjunction with the female population estimated in step (b).

d. Use school enrollment data to estimate the 5 through 14 year olds. This is accomplished by taking the school enrollment for the estimate year and dividing by the rate of school enrollment for this particular age group.

e. Estimate the population under 5 years old by means of color specific fertility ratios (the ratio of children under five to females 20 through 34), adjusted to reflect national trends.

f. Sum the age-sex-color specific estimates produced in steps (a)-(e) to yield a composite estimate.

The major drawback to this as well as other composite methods is the vast amount of data needed. In small areas one is fortunate to have even a small part of the data needed for making composite estimates. This makes the next types of estimates very appealing since not only are they easiest to perform but also they use one set of data to estimate the population directly.

(3) Censal-Ratio Methods

Censal-ratio methods use current symptomatic data to estimate total population, or total population change, directly rather than merely the component of migration. Basically, in utilizing this method one computes the ratio of the symptomatic data to the total population at the census date, extrapolates this ratio to the estimate date and divides the value from the symptomatic series at the estimate date, by the ratio, yielding an estimate of total population. More often than not the extrapolated ratio is assumed to remain constant from the census data so that the procedure is further simplified.

Many series of data have been considered useful as "symptomatic" series. This list includes school enrollment or school census data, electric, gas or water installations or customers, volume of bank receipts, volume of retail trade, number of building permits issued, number of residential postal "drops," voter registration, welfare recipients, auto registration, birth and death statistics, and tax returns. Variants of the censal-ratio method are usually classified by the types of data that are employed in making the estimates. Some of the variants are:

a. Vital rates method. This method uses birth and death rates to arrive at two independent population estimates which are then averaged to derive a single composite estimate. The general equations for the vital rates method at the town or city level would be:

$$TPB2 = (CBR1 \cdot TB2) \div (CBR2 \cdot TBR1)$$

where

TPB2 = population estimate of the town or city based on birth rates.

CBR1 = county birth rate during census year.

TB2 = number of births in the town or city during the estimate year.

CBR2 = county birth rate during estimate year.

TBR1 = town or city birth rate during the census year.

An estimate based on death rates, TPD2, is then compiled in a similar manner and the two estimates TPB2 and TPD2 are then averaged for a final estimate. As would be expected in towns and cities with small population, this type of estimate is not at all stable. This problem can be overcome somewhat by averaging the birth and death data over a three-year period.

b. Simple-ratio method. Estimates for local areas (cities) are computed by using population estimates for larger areas (counties) and assuming constant city-county growth ratios from the census years. This relationship can be represented by the following equation for a city or town:

$$PT2 = PT1 \cdot PC2 \div PC1$$

where

PT2 = population estimate of the city or town.

PT1 = population of the town or city during the census year.

PC2 = population estimates of the county.

PC1 = population of the county during the census year.

As revealed in the above equation, this is the most widely used and simplest method of obtaining local area estimates. The assumption that a town or city is growing at the same rate as the parent county is rarely valid. However, in some instances because of the lack of data, this is the only type of estimate that is possible.

c. Housing units method. Some indicators reflect changes in the number of housing units or households rather than in the number of individuals. These indicators include the number of building permits issued within a local area, electric, gas, or utility customers, residential postal delivery, etc. The housing unit method uses these types of data to estimate the number of housing units or households in the estimate year which in turn is used to estimate total population. The basic formula for estimating the current population in households, without allowance for change in average size of household, is:

$$P_2 = (H + U) \div \frac{P_1}{H}$$

where

P_2 = population in households on estimate date

H = occupied housing units on the last census date

U = net increase in occupied housing units between census date and estimate date

P_1 = population in households on the last census date

If it is felt the vacancy or occupancy rates are not the same at the estimate date as they were at the census date, the P_2 is adjusted accordingly.

d. Ratio-difference method. This censal ratio procedure uses a difference estimator to update the ratio of symptomatic data to population from the base year to the time for which the estimate is desired. As stated earlier, the estimated population for an area is given in the following equation

$$P_2 = \frac{S_2}{R_2}$$

where

P_2 = current population estimate for small area

S_2 = current value of symptomatic data

R_2 = extrapolated or updated ratio of the value of the symptomatic data at the base date to the population figure at that same date.

In the ratio-difference method R_2 is estimated by using the value of R_2 at the base date, say R_1, and updating it with current and past ratios at a level (county) higher than that of the local area. For instance, if r_1 and r_2 represent the past and current values, respectively, of the ratios of the symptomatic data to population of the higher level unit, the estimate of R_2, designated by $\widehat{R_2}$, is given by the difference estimator:

$$\widehat{R_2} = R_1 + r_2 - r_1$$

which is to say that the value of R_1 is changed by the same rate as is r_1. If the local area happens to be a city and the higher level ratios are in terms of county data, then the ratio of symptomatic data to population at the city level is assumed to change at the same rate as at the county level. Symptomatic data commonly used in this method are automobile registration, voter registration, and other types of personal registrations.

(4) Ratio-Correlation Methods

These methods involve mathematically relating changes in one or more indicator series to population changes by using multiple linear regression. More specifically, a multiple linear regression equation is derived to express the relationship between the changes over population counts to

"independent symptomatic" variables highly correlated with these changes. Most of the data mentioned in this report can be used as the independent variable. The success of the ratio-correlation method depends upon the accuracy of the underlying assumption that the observed statistical relationship between the independent and dependent variables during the time series will persist. Furthermore, one must assume that deficiencies in coverage in the basic data series will remain constant, or change very little in the estimate period.

DIVISION OF RESEARCH AND INFORMATION SYSTEMS
DEPARTMENT OF COMMUNITY AFFAIRS
STATE OF MONTANA

SURVEY OF CURRENT
CITY POPULATION ESTIMATION PROGRAMS

STATE	REPLIED TO SURVEY	CITY POPULATION ESTIMATION PROGRAM - TYPE WITHIN STATE GOVERNMENT	FOR FURTHER INFORMATION CONTACT
Georgia	Yes	No current city estimation program	Division of State Planning State Data Center Atlanta, Georgia 30334
Hawaii	Yes	No current city estimation program	Department of Planning & Econ Dev 250 South King Street P. O. Box 2359 Honolulu, Hawaii 96813
Idaho	Yes	No current city estimation program	Wallace Hedrick, Assoc. Chief Division of Budget and Policy Plan. State Capitol Boise, Idaho 83720
Illinois	Yes	No current city estimation program	Thomas Langford, Assistant Director Bureau of Budget State Capitol Springfield, Illinoi 62706
Indiana	Yes	Yes, censal-ratio method based on school enrollment	Robert A. Calhoun, Director State Board of Health Public Health Statistics State Capitol Indianapolis, Indiana 46206
Iowa	No reply		
Kansas	Yes	No, but census of cities is taken annually.	Paul L. Jams, Spec. Asst Secretary Kansas State Board of Agric. State Office Building Topeka, Kansas 66612
Kentucky	Yes	No current city estimation program	Ronald Morgan, Ass't Director Research and Planning State Capitol Frankfort, Kentucky 40601

DIVISION OF RESEARCH AND INFORMATION SYSTEMS
DEPARTMENT OF COMMUNITY AFFAIRS
STATE OF MONTANA

SURVEY OF CURRENT
CITY POPULATION ESTIMATION PROGRAMS

STATE	REPLIED TO SURVEY	CITY POPULATION ESTIMATION PROGRAM - TYPE WITHIN STATE GOVERNMENT	FOR FURTHER INFORMATION CONTACT
Louisiana	Yes	Yes, housing unit method	Mr. Don Wilcox Dept. of Bus. & Econ. Res. Louisiana Tech Univ. P. O. Box 5796 Ruston, Louisiana 71270
Maine	Yes	Yes, component method	Mr. Dale Welch, Director Research and Vital Records State Capitol Augusta, Maine 04330
Maryland	Yes	No current city estimation program	Mr. Art Benjamin, Chief Department of State Planning State Capitol Baltimore, Maryland 21201
Massachussetts	Yes	No, but census of cities is taken annually.	Ann Hurd, Director Governor's Public Service Office State Capitol Boston, Massachusetts 02133
Michigan	No reply		
Minnesota	Yes	No current city estimation program	Victor Arnold, Director Development Planning 100 Capitol Square Building 550 Cedar Street St. Paul, Minnesota 55101
Mississippi	Yes	No current city estimation program	Research & Development Center P. O. Drawer 2470 Jackson, Mississippi 39205
Missouri	Yes	No current city estimation program	Bill Cramer, Director Division of State Planning & Analysis State Capitol Jefferson City, Missouri 65101

DIVISION OF RESEARCH AND INFORMATION SYSTEMS
DEPARTMENT OF COMMUNITY AFFAIRS
STATE OF MONTANA

SURVEY OF CURRENT
CITY POPULATION ESTIMATION PROGRAMS

STATE	REPLIED TO SURVEY	CITY POPULATION ESTIMATION PROGRAM - TYPE WITHIN STATE GOVERNMENT	FOR FURTHER INFORMATION CONTACT
Montana	Yes	No current city estimation program	Division of Research & Information Dept. of Community Affairs Capitol Station Helena, Montana 59601
Nebraska	Yes	No current city estimation program	College of Business Administration Bureau of Business Records University of Nebraska Lincoln, Nebraska 68508
Nevada	Yes	No current city estimation program	Bruce Arkell, Planning Coordinator State Capitol, Room 57 Carson Ctiy, Nevada 89701
New Hampshire	Yes	Yes, composite method, trend method, regression method, housing unit method	Office of Comprehensive Planning State Capitol Concord, New Hampshire 03301
New Jersey	Yes	Yes, component method	Joseph Hoffman, Commissioner Department of Labor & Industry P. O. Box V Trenton, New Jersey 08625
New Mexico	Yes	No current city estimation program	Bureau of Business & Economic Research University of New Mexico Alburquerque, New Mexico 87106
New York	Yes	Yes, component method	Department of Health State Capitol Albany, New York 12237
North Carolina	Yes	Yes, simple ratio method	Office of State Planning 116 West Jones Street Raleigh, North Carolina 27603
North Dakota	Yes	No current program	

DIVISION OF RESEARCH AND INFORMATION SYSTEMS
DEPARTMENT OF COMMUNITY AFFAIRS
STATE OF MONTANA

SURVEY OF CURRENT
CITY POPULATION ESTIMATION PROGRAMS

STATE	REPLIED TO SURVEY	CITY POPULATION ESTIMATION PROGRAM - TYPE WITHIN STATE GOVERNMENT	FOR FURTHER INFORMATION CONTACT
Ohio	Yes	Yes, simple ratio method	Department of Econ. & Comm. Devel. 30 East Brood Street Columbus, Ohio 43215
Oklahoma	Yes	Yes, component & regression method average for selected cities only	Employ. Sec. Commission State Capitol Oklahoma City, Oklahoma 73105
Oregon	Yes	Yes, housing unit method	Center for Population Research & Census Portland State University P. O. Box 751 Portland, Oregon 97207
Pennsylvania	Yes	Yes, vital rates method	Walter Arader Department of Commerce State Capitol Harrisburg, Pennsylvania 17120
Rhode Island	Yes	No current city estimation program	
South Carolina	Yes		
South Dakota	Yes	No current city estimation program	State Planning Bureau State Capitol Pierre, South Dakota 57501
Tennessee	Yes	No current city estimation program	State Planning Office 660 Capitol Hill Building Nashville, Tennessee 37219
Texas	Yes	No current city estimation program	State Planning & Development Office of the Governor State Capitol Austin, Texas 78711

DIVISION OF RESEARCH AND INFORMATION SYSTEMS
DEPARTMENT OF COMMUNITY AFFAIRS
STATE OF MONTANA

SURVEY OF CURRENT
CITY POPULATION ESTIMATION PROGRAMS

STATE	REPLIED TO SURVEY	CITY POPULATION ESTIMATION PROGRAM - TYPE WITHIN STATE GOVERNMENT	FOR FURTHER INFORMATION CONTACT
Utah	Yes	No current city estimation program	State Planning Coordinator 118 State Capitol Salt Lake City, Utah 84114
Vermont	No reply		
Virginia	No reply		
Washington	Yes	Yes, housing unit method	Office of Program Planning & Financial Management House Office Building Olympia, Washington 98504
West Virginia	No reply		
Wisconsin	Yes	Yes, ratio difference method	Gerald Ferwerda, Information Systems Chief Department of Administration State Capitol Madison, Wisconsin 53702
Wyoming	Yes	No current city estimation program	Dr. Roger Hayen Business & Economic Research Commerce Building, Room 219 University of Wyoming Laramie, Wyoming 82071

IV Bibliography for Small Area Estimation

Atchley, Robert C. "A Shortcut Method for Estimating the Population of Metropolitan Areas," Journal of the Institute of Planners, 34:259-62, 1968.

Bogue, Donald J. "A Technique for Making Extensive Population Estimates," Journal of the American Statistical Association, 45(250):149-163, June 1950.

Bogue, Donald J. and Duncan, Beverly. "A Composite Method for Estimating Postcensal Population of Small Areas by Age, Sex, and Color," National Office of Vital Statistics, Vital Statistics - Special Reports, Vol. XLVII, No. 6, Aug. 24, 1959.

Goldberg, David, and Balakrishnan, T. R. "A Partial Evaluation of Four Estimation Techniques," Michigan Population Studies, No. 2. Ann Arbor, Mich., Department of Sociology, University of Michigan, 1961.

Goldberg, David, Feldt, Allan, and Smit, J. William. "Estimates of Population Change in Michigan: 1950-1960," Michigan Population Studies, No. 1, Ann Arbor, Mich., Department of Sociology, University of Michigan, 1960.

Goldberg, David, Rao, V. R., and Namboodiri, N. K. "A Test of the Accuracy of Ratio Correlation Population Estimates," Land Economics, 40(1):100-104, Feb. 1964.

Harewood, J. "Deriving Current Estimates of the Population of Trinidad and Tobago by Administrative Areas and by Age," in International Union for the Scientific Study of Population, Sydney Conference, Contributed Papers, Sydney, Australia, 1967, pp. 937-948.

Hillery, George A., Jr. Postcensal Population Estimates for Small Areas: An Evaluation of Selected Techniques. Agricultural Experiment Station, KAES RS-17, Lexington, Ky., University of Kentucky, Sept. 1962.

Hallman, Walter P. Population Estimating and the Census of 1970, The California Experience, Department of Finance, Sacramento, Ca. 1970 (Unpublished).

Jeffries, Dorothy A. and Heller, Robert W. An Evaluation of Several Methods of Estimating County Populations, Minnesota - 1960, St. Paul, Minnesota.

Lee, Shin-jong. An Evaluation of Small Area Population Estimation and Projection Techniques, Master's Thesis, Iowa State University of Science and Technology, Ames, Iowa, 1966.

Morrison, Peter A. Demographic Information for Cities: A Manual for Estimation and Projecting Local Population Characteristics. RAND Report R-618-HUD, June 1971.

Poole, Richard W., et al. "An Evaluation of Alternative Techniques for Estimating County Population in a Six-State Area," College of Business, Economic Research Series No. 3, Stillwater, Okla., Oklahoma State University, 1966.

Pursell, Donald E. "Improving Population Estimates with the Use of Dummy Variables," Demography, 7(1):87-91, Feb. 1970.

Rosenberg, Harry. "Improving Current Population Estimates Through Stratification," Land Economics, 44(3):331-338, Aug. 1968.

Schmitt, Robert C. "Short-Cut Methods of Estimating County Population," Journal of the American Statistical Association, 47(258):232-238, June 1952.

Schmitt, Robert C. and Crosetti, Albert H. "Accuracy of the Ratio-Correlation Method for Estimating Postcensal Population," Land Economics, 30(3):279-280, Aug. 1954.

Schmitt, Robert C., and Grier, John M. "A Method of Estimating the Population of Minor Civil Divisions," Rural Sociology, 31(2):355-361, June 1966.

Schneider, J. R. L. "Note on the Accuracy of Local Population Estimates," Population Studies (London), 8(2):148-150, Nov. 1954.

Shryock, Henry S. "Development of Postcensal Population Estimates for Local Areas," in Studies in Income and Wealth, Vol. XXI, Regional Income, National Bureau of Economic Research, Princeton, N. J., Princeton University Press, 1957. Pp. 377-399.

Siegel, Jacob S. "Status of Research on Methods of Estimating State and Local Population." Proceedings of the Social Statistics Section, 1960. American Statistical Association, Washington, D. C. pp. 172-179.

Siegel, Jacob S., Shryock, Henry S., and Greenberg, Benjamin. "Accuracy of Postcensal Estimates of Population for States and Cities," American Sociological Review, 19(4):440-446, Aug. 1954.

Silcock, H. "Precision in Population Estimates," Population Studies (London), 8(2):140-147, Nov. 1954.

Starsinic, Donald E., and Zitter, Meyer. "Accuracy of the Housing Unit Method in Preparing Population Estimates for Cities," Demography, 5(1):475-484, 1968.

Tarver, James P. et al, "An Evaluation of Alternative Techniques for Estimating County Populations in a Six-State Area," Research Series No. 3. Oklahoma State University, College of Business, Stillwater, Oklahoma, 1965.

U. S. Bureau of the Census. Current Population Reports, Series P-25, No. 432. "Estimates of the Population of 100 Large Metropolitan Areas: 1967 and 1968," Oct. 3, 1969.

_____. Current Population Reports, Series P-25, No. 454. "Inventory of State and Local Agencies Preparing Population Estimates: Survey of 1969," Dec. 1970.

_____. Current Population Reports, Series P-25, No. 339. "Methods of Population Estimation: Part 1, Illustrative Procedure of the Census Bureau's Component Method II," June 6, 1966.

_____. Current Population Reports, Series P-25. No. 436. "Estimates of the Population of States: July 1, 1968 and 1969," Jan. 7, 1970.

_____. Current Population Reports, Series P-25. No. 437. "Estimates of the Population of States, by Age, 1968, With Provisional Estimates for July 1, 1969," Jan. 16, 1970.

_____. Current Population Reports, Series P-25, No. 460, "Preliminary Intercensal Estimates of States and Components of Population Change, 1960 to 1970," June 7, 1971.

_____. Current Population Reports, Series P-23, No. 31, "Use of Social Security's Continuous Work History Sample for Population Estimation," April 10, 1970.

_____. Current Population Reports, Series P-25, No. 304, "Revised Estimates of the Population of States and Components of Population Change: 1950 to 1960," April 8, 1965.

Zitter, Meyer, and Shryock, Henry S. "Accuracy of Methods of Preparing Postcensal Population Estimates for States and Local Areas," Demography, 1(1):227-241, 1964.

Zitter, Starsinic, and Word. "Accuracy of Methods of Preparing Postcensal Population Estimates for Counties: A Summary Compilation of Recent Studies," paper presented at meeting of the Population Association of America, Boston, April 18-20, 1968.